A Comparison of High, Medium and Low Fidelity Simulation for Advanced Cardiac Life Support (ACLS) Training: Preliminary Results

Andrew Adams, MD

Introduction: The traditional model of surgical education has been practice-based learning in which valuable psychomotor skills are acquired by repeatedly performing a task under supervision until one becomes proficient. Over the last 2 decades medical education, and by extension the teaching of surgical techniques, has undergone a shift towards the increased use of simulation. This has largely been influenced by the reduction in the quantity and quality of operating room time available to surgical residents due to shorter workweek for residents, emphasis on operating room efficiency, increasing complexity of cases and greater emphasis on mitigating medical error. At the same time improved technology has led to the development of an ever-increasing number of complex, high fidelity simulators which more accurately mimic the real environment. The sky-rocketing costs of these simulators, coupled with their questionable impact on learning outcomes, have prompted many to ask the question: How much simulation fidelity is enough? The purpose of our study was to examine a range of simulation fidelity to see if we could determine at what level does additional fidelity become superfluous with respect to learning outcomes.

Methods: Thirty-five second-year medical students and physician assistant students underwent stratified randomization based on amount of prior medical experience to one of four study groups: Control, low fidelity, medium fidelity and high fidelity. All participants received Advanced Cardiac Life Support training via a didactic lecture session. The low fidelity group’s training was augmented with videos of professionals running “Megacode” scenarios. The medium fidelity group also performed code scenarios using the DARTsim software which displays vital signs and cardiac rhythms common to ACLS. The high fidelity group performed code scenarios with a manikin, fully-stocked crash-cart, cardiac monitor and team-members to perform assigned tasks. All participants completed a baseline written pretest of ACLS knowledge, a performance (Megacode) exam, and a written posttest at the end of the study. The scores from these tests were used to evaluate individual and group performance differences.

Results: A statistically significant improvement in ACLS knowledge was evident for each group from pre- to post-test (all p<.005). The control group did significantly worse than all other groups on the written post-test (all p<.01) while the medium fidelity group did better than the low (p=.018). On the Megacode performance test, the medium and high fidelity groups performed significantly better than the control group (p=.01, p=.022). There was no significant difference in performance among low, medium and high fidelity groups during the Megacode test, though there was a trend towards better performance for the medium fidelity group. There was a trend towards better performance in participants who had previous medical/ACLS experience though this did not reach statistical significance.

Conclusion: Simulation training is associated with better learning outcomes when compared to traditional didactic lectures only. There is a trend towards better learning with medium fidelity simulation, which may indicate that high fidelity is superfluous. Further studies with larger numbers of participants are needed to better evaluate this trend.